

**AMENDMENTS TO THE SPECIFICATION**

Please replace paragraph [0011] with the following amended paragraph:

[0011] The best fit parameters of a function that is nonlinear cannot be directly calculated in general, forcing the use of iteration techniques, that require initial guesses for the parameters, that can consume large amounts of computer time, and ultimately can fail to find a result. Such a limitation of the prior art is described in "Numerical Recipes," William H. ~~Press, et al,~~ Press et al., page 521, Cambridge University Press, 1986, New York, N.Y. Fortunately, in the case of an exponential decay to a known background level, it is possible to transform the function by a logarithmic transformation into a linear one that easily can be fit. This technique is described in "Data Reduction and Error Analysis For The Physical Sciences," Philip R. Bevington and D. Keith Robinson, page 134, Second Edition, McGraw-Hill, Inc. New York, N.Y. This method can be applied to the digitized data after the subtraction of any DC level that is present from the electronic processing. That level may be obtained at the beginning of the measurement process by taking a measurement with no ring-down signal or preferably on each record to eliminate possible drift by measuring the DC offset far into the exponential decay where the signal has fallen significantly below the background noise amplitude. The variance in that level is used as an estimate for the variance of the data points and in the subsequent weighting of the linearized fit, as shown in "Pulsed, single-mode cavity ring-down spectroscopy," Roger D. van Zee, ~~et al,~~ Zee et al., Applied Optics, 38, 3951(1999).

Please replace paragraph [0012] with the following amended paragraph:

[0012] Once the data has been conditioned by removal of the DC level, an additional conditioning is necessary before the logarithmic transformation can be made. Data points that are of zero value or negative have no real logarithm and are ~~thus, removed~~ thus removed. These data points first appear once the

exponential decaying signal is comparable with the noise and define the data cutoff point for fitting. In addition, a few of the initial data points are also removed because of transients in the radiation switching. The estimates for the parameters are then obtained from the weighted linear least squares fit to the logarithm of the conditioned data. Here, where  $y = A \exp\{-rt\}$ , the amplitude,  $A$ , and the decay rate,  $r$ , are the parameters. The variables are  $y$ , the voltage above background, and  $t$ , the time after initiation of the ring-down.

Please replace paragraph [0039] with the following amended paragraph:

[0039] Laser 20 may alternately be one of a number of different types of lasers such as a distributed feedback (DFB) laser, an "external cavity" diode laser or an optical fiber laser. Laser 20 can be temperature tuned by a temperature controller 30.